ORIGINAL RESEARCH PAPER

Volume-9 | Issue-2 | February-2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

NUMERICAL DISTRIBUTION AND RELATIONSHIP OF MAST CELLS IN HUMAN CORONARY ARTERIES

Anatomy

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KEYWORDS

INTRODUCTION:

The role of heparin as anticoagulant is well established and one of its sources in the human body is considered to be the mast cell. The mast cells are known to be distributed within and around the wall of blood vessels. It is presumed that the subintimal distribution of these cells is responsible directly for preventing thrombosis or atherosclerosis either because of anticoagulant activity of heparin or because of its capacity to transport fats from the blood stream. However, the actual cause of a plaque to rupture is not yet established. Interestingly, pathology studies have shown an increased presence of the mast cell, an important inflammatory effector cell in allergy and host defense, in (peri)vascular tissue during plaque progression, which may point towards a causal role for mast cells.

In 1876 during his thesis research Paul Ehrlich discovered a new, highly potent inflammatory cell type and designated it “mast cell”, after the basophilic storage granules [1-3]. Mast cells were found to respond to various exogenous signals from bacteria, viruses and parasites via recognition receptors, such as Toll-like receptors and immunoglobulins [4-6]. Mast cells are not only involved in first line defence against pathogens but also represent important mediators in diseases such as allergy and asthma, once they become dysregulated in response to an excess of allergen or allergen-specific IgE [5, 6]. Mast cells are laden with granules containing a wide variety of mediators, such as the proteases chymase, tryptase and the cathepsins, the vasoactive histamine, heparin and a plethora of cytokines such as Tumor Necrosis Factor α (TNFα), chemokines (e.g. Interleukin 8 (IL-8)) and other growth factors (e.g. Vascular Endothelial Growth Factor (VEGF), basic Fibroblast Growth Factor (bFGF)) [6].

According to Holmgren and Willander (1937), cytoplasmic granules of mast cells consist of a substance having properties like those of heparin. This has been verified by Jorpes et al (1937) and Hirst (1938). Quantitative data on the distribution of mast cells have been reported for number of human and animal tissues by many workers. Possibly the most comprehensive is that of Hellstrom and Holmgren (1950) who studied the mast cells in human skin and heart from a large series of autopsy cases. The number of mast cells and their relationship with age in the human beings and variety of animals has been established. However, the work on the distribution of mast cells in and around the blood vessels has been rather restricted.

Human pathology studies have provided ample evidence for the presence of a variety of immune and inflammatory cell types in diseased tissue and these studies have been essential in identifying the major cellular players in the progression of disease. Mast cells can easily be detected in tissue sections through a variety of mast cell staining protocols that are available at present. Mast cell deficient animals were reported already in 1978, when Kitamura and colleagues first described W/Wv mice that were virtually devoid of tissue and skin mast cells [7]. what changes are brought about in the distribution and morphology of mast cells in coronaries with advancing age? It has been suggested that presence of mast cells in relation to coronaries may protect against the occurrence of atherosclerosis, while their absence predisposes to it.

The present study was undertaken to establish a possible relationship, if any between distribution of mast cells and coronary arteries of the apparently healthy individuals.

MATERIAL AND METHODS:

Twenty human hearts were collected for the present study. The hearts were examines for any scarring,infarction or coronary occlusion; cases with any of the above changes were rejected. Soon after removal of hearts, the right and the left coronary arteries along with their interventricular branches were dissected. One centimeter long segment from each of these arteries was cut from their commencement, and soon fixed in 10 % chilled neutral formalin for 24 hours. Then these segments were subjected to routine dehydration and were cleared in cedar wood oil. Thereafter, they were embedded in paraffin wax by vaccum embedding method. Seven micron thick serial sections were cut, mounted and labeled. These sections were stained by Haematoxyline & Eosin, Toluidine blue in acetate buffer and Gomori's aldehyde fuschin methods. The distribution of mast cells (exhibiting metachromasia) in the tunica media and tunica intima of the coronary arteries was examined under the high power of microscope. The number of mast cells was counted in 5 different fields of 5 alternate sections. An average number is thus calculated and recorded.

RESULTS:

In tunica media and intima small round or oval cells with fine lightly stained granules are seen.

DISCUSSION:

Coronary arteries of twenty human hearts were studied, out of which in only 10 specimens the mast cells could be revealed. These 10 specimens were collected within 12 hours after death. Since no mast cell could be seen in the coronary arteries of the other 10 specimens, they were not included in the observation. Five different fields in five alternate sections were studied under high power of microscope. The total number of mast cells in thus counted in 25 fields was recorded. Following observations were seen – In tunica media and intima only stray mast cells are seen in some sections.

Our study results were found the distribution of mast cells in men and found them exclusively near the small blood vessels without muscle coats.And it is very close to the walls of blood vessels and even in the coats of blood vessels. This appears to be more in keeping with view of Riley (1953), where the blood vessels are surrounded by a sheath of fibro-fatty tissue, the mast cells lie between the vessel and the surrounding fat and are often disposed in chains parallel to the vessel wall (8-14).

In human being the mast cells do not produce serotonin and the two types of the cells in the present study are demonstrated by metachromasia. What has been described by Riley, is In animal the mast cells produce serotonin in addition to heparin and histamin. Although it could be due to difference in the secretion of rat's mast cells as compared to man.

CONCLUSION:

Intimal mast cells have got little role in preventing intravascular clotting, The mast cells with fine granules are situated in tunica media and intima. There is a wide body of evidence suggesting a pivotal role for MC in different aspects of cardiovascular disease. MC are abundant in atherosclerotic plaques. We believe that in addition to the now extensive work that has already been done in vitro and in animal studies, it is now time for intervention studies in humans to study the effect of targeting MC for atherosclerosis.

Table: 1 Average number of Mast cells per high power field.

S. No	Specimens	Left Coronary Artery	
		Tunica Media	Tunica Intima
1	Heart 1	0.02	0.00
2	Heart 2	0.04	0.04
3	Heart 3	0.04	0.04
4	Heart 4	0.02	0.00
5	Heart 5	0.08	0.00
6	Heart 6	0.08	0.00
7	Heart 7	0.12	0.04
8	Heart 8	0.12	0.04
9	Heart 9	0.08	0.00
10	Heart 10	0.04	0.00

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